

Stress and Structure Evolution During Formation of Polycrystalline Metallic Films: From Adatoms to Coalescence

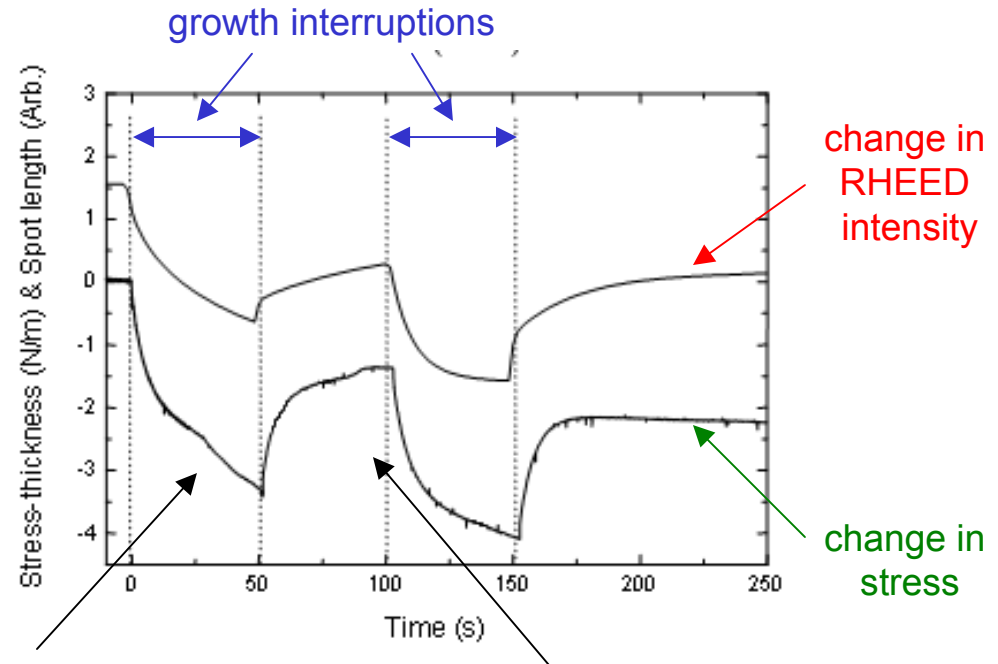
DMR-0302044: Carl V. Thompson, Department of Materials Science and Engineering, M.I.T.

- High sensitivity, high sampling rate tools for real-time, in-situ stress measurements have been developed.
- Reversible stress changes have been observed during growth interruptions in all stages of Volmer-Weber growth (before, during, and after coalescence).

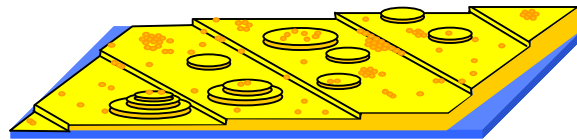
C. Friesen and C.V. Thompson, Phys. Rev. Letts. **89**, 126103 (2002).

C. Friesen, S.C. Seel, and C.V. Thompson, J. Appl. Phys. **95**, 1011 (2004).

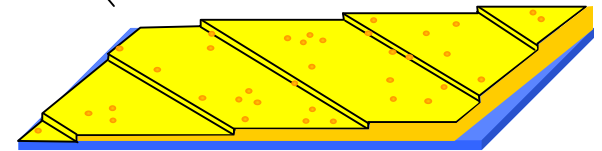
- Correlation of changes of stress and reflected high energy electron diffraction intensity demonstrates that surface defects cause compressive stress.



In-situ, real-time stress measurements provide a probe of surface structure during film growth.



High surface defect concentration during growth.



Low surface defect concentration during interruption in growth.

C. Friesen and C.V. Thompson, Phys. Rev. Letts. **93**, 056104 (2004).

Educational and Outreach Activity

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Results from NSF research have been included in MIT courses;

3.44* Electronic Materials and Thin Film Processing, and

3.48J** Materials and Processes for Microelectromechanical Devices and Systems

and courses for professional engineers and scientists in summer short courses;

3.50s Thin Films and Small Volume Structures: Stresses, Deformation and Reliability

6.74s Multilevel Interconnect Process Technologies for Microelectronic Fabrication

*simultaneously attended by students

in classrooms in Singapore as well as MIT

** jointly offered with 4 other Engineering departments at MIT, and *simultaneously*

attended by students in classrooms in Cambridge UK, Singapore, and MIT



NSF work involves collaborations with 2 other faculty at MIT and one in Singapore, research results are discussed in group meetings of all groups (and in regular videoconferences with Singapore, below).

